The National Missile Defense System

Affordable Acquisition Strategy and Industrial Capabilities

EDDIE JAPZON • DR. KRIS SWAMINATHA
MICHAELEE MOFFITT

Today's National Missile Defense (NMD) Program evolved from "Star Wars" in the 1980s. Unlike the "Star Wars" global protection vision, the NMD Program approach to missile defense is to provide an initial capability to protect against a limited ballistic missile threat, with the ability to evolve to a more advanced capability to counter future threats. In an April 1996 memorandum, the Secretary of Defense designated the NMD Program an Acquisition Category (ACAT) ID program, transitioning the previous technology readiness program to a deployment readiness program.

"3+3" Program — Acquisition Strategy

The Ballistic Missile Defense Organization (BMDO) formulated the "3+3" program for National Missile Defense (NMD) — to develop, test, and demonstrate a capability in three years that can be produced and deployed in an additional three years. At the end of the first three years, a decision will be made based on the perceived threat at that time, either to deploy the system or to continue development to meet the demand of a more complex threat.

To increase the likelihood of program success, our NMD Joint Program Office (JPO) implemented "3+3" using the practices, processes, and procedures embodied in DoD's Acquisition Reform initiatives.

First, to control program costs and assure an affordable system, we mandated the use of commercial-off-the-shelf and non-developmental items where feasible; and an Open Systems Architecture approach to system design to minimize life-cycle costs and permit easy insertion of new technology without system redesign.

We also adopted the integrated product team (IPT) concept, forming diverse IPTs to deal with program problems and issues expeditiously, thus avoiding further delays.

Spotting Potential Problems

Current trends in industrial capabilities, resulting from cuts in defense spending, have impacted many major weapon system programs. To avoid similar problems, we conducted an assessment early in the program's development phase, to identify potential problems that may impact future production and deployment. The importance of this assessment is underscored by the program manager's decision to include the assessment in the Defense Acquisition Board (DAB) requirement.

NMD Program

The NMD Program is unlike any other Major Defense Acquisition Program (MDAP) in two respects. First, the acquisition activities in most MDAPs — development, production, and deployment — average 12 to 16 years. In contrast, the

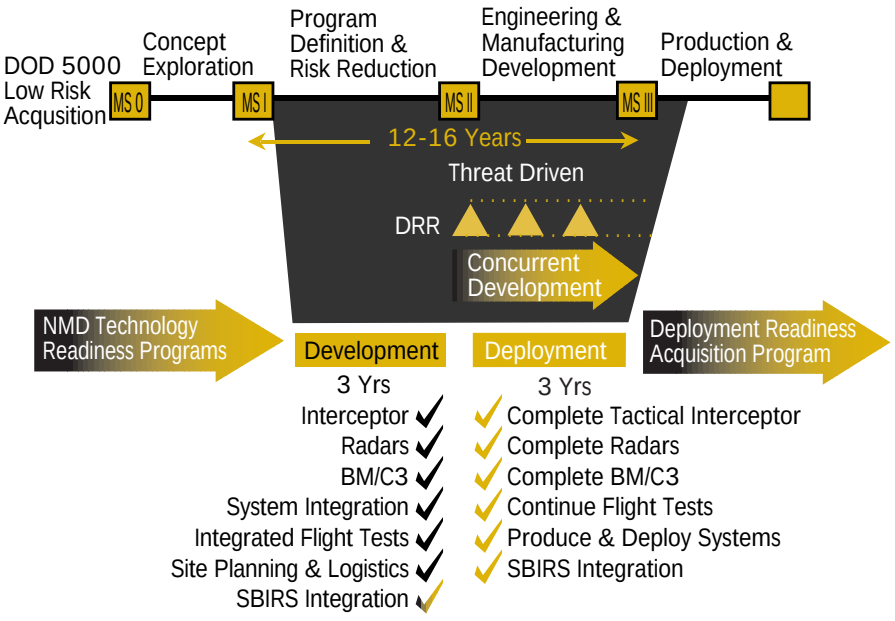

FIGURE 1. "3+3" Streamlined Acquisition

Japzon is an Industrial Engineer in the National Missile Defense Joint Program Office. Swaminatha holds a Ph.D. in Economics and is employed by Raytheon Systems Company. Moffitt is a Senior Engineer with the Science Applications International Corporation.

NMD Program is a "3+3" streamlined acquisition program, as illustrated in Figure 1.

Second, the system design is constantly evolving to keep pace with a changing threat. NMD has adopted a "Plug and Defend" strategy for design flexibility. This approach involves development of a set of elements — radar, interceptors, and battle management command and control communications — termed the NMD "Element Toolbox."

NMD System Architecture

The NMD "Element Toolbox" (Figure 2) is composed of several elements that are required to perform unique functions in a ballistic missile defense engagement. The ground-based interceptor (GBI) is the weapon element that engages and destroys the threat. The ground-based sensors, X-band radar (XBR) and upgraded early warning radar (UEWR); the space-based sensors, Defense Support Program (DSP); and Space-Based Infrared System (SBIRS) provide the dual-sensor phenomenology required to address the full spectrum of potential threats. Providing human-in-control communications between all these elements is the Battle Management Command, Control and Communications (BMC3).

The NMD architecture roadmap provides for an initial capability, C1, to combat a simple threat. The C1 capability includes a limited quantity of GBIs; XBRs; UEWRs consisting of Ballistic Missile Early Warning Radar (BMEW) upgrades, COBRA DANE, and a new X-band radar; SBIRS using the fielded DSP; and a BMC3 element. The BMC3 interfaces with the National Command Authorities and Other External Systems/Centers for command coordination, threat validation, and information interchange.

The C2 capability will be an extension of the C1 capability to combat a more complex threat. It will require an increase in the number of GBIs and XBRs, and will depend more heavily on the space-based systems. The C3 capability will be a more advanced system with greater performance parameters to handle threats that are increasingly more complex.

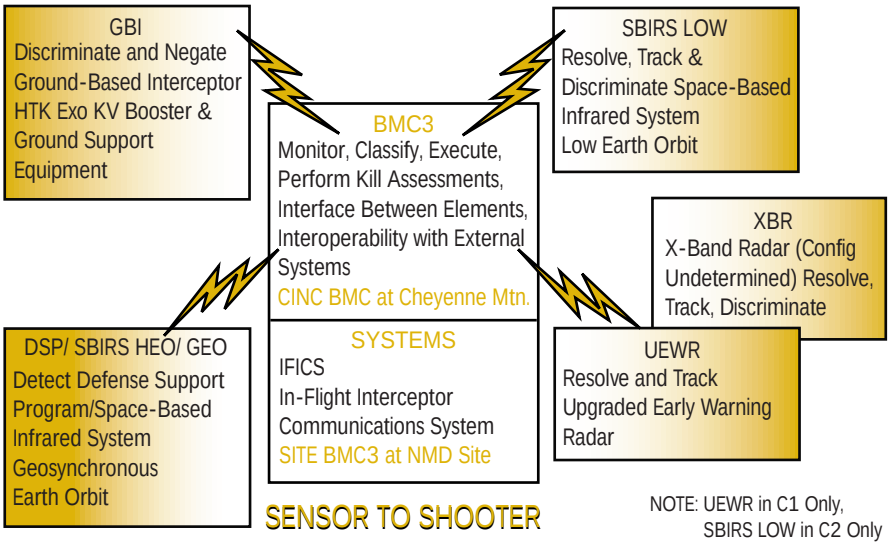

FIGURE 2. NMD System Elements

NMD Industrial Capabilities Assessment

The Producibility and Manufacturing Working Group, a subgroup of the Deployment Readiness IPT, performed the industrial capabilities assessment. All relevant players, working in partnership — -the NMD JPO, the Element Program Offices, users, contractors, and Office of the Deputy Under Secretary of Defense (Industrial Affairs and Installations) Directorate of Industrial Capabilities and Assessments — made up the Working Group membership.

Since we conducted the assessment early in the development phase, this initial assessment concentrated on the key technologies, and components and vendors that may impact the system development. The Industrial Capabilities Assessment is a living document and will be updated as the program transitions to production and deployment.

In the absence of viable data specifically for the NMD Program, we based the Industrial Capabilities Assessment on information obtained from visits to the development contractors' facilities, and a literature review of over 40 related defense industry sector studies.

As part of our assessment, we also evaluated the health of a given vendor or sector in terms of several broad business factors: commercial and military sales trends; the financial standing of the producers; and the ability of the production base to support future sustainment needs. Additionally, the criticality of a component and/or subcontractor/vendor was based on the criteria established by DoD: *sole source, single source, offshore source, long-lead-time item, sustainment capability, and technology maturity.*[1]

Major Trends in The Industrial Base

Significant changes in U.S. industrial capabilities have emerged in the post-Cold War era. A rapid shrinking defense industrial capability, diminishing manufacturing sources (DMS), and increased foreign dependency for high-tech products and technologies have resulted from cuts in defense spending in recent years. How and to what extent these changes will impact element production was the focus of the Industrial Capabilities Assessment.

Shrinking Industrial Capabilities

A review of several defense industrial sector studies showed a substantial decrease in the number of sub-tier vendors supporting the defense industry due to defense budget cuts. This is especially true for aerospace and electronics industries, the primary industries involved

in the NMD Program. The aerospace industry is facing serious challenges from continuing cuts in defense spending, a weak global demand, and increasing international competition. In the last 10 years, cuts in the real defense budget for aerospace products, both in the United States and in other developed countries, have reduced purchases for military aircraft, missiles, and related equipment from U.S. suppliers.

A similar trend in the defense electronics industry has occurred. In 1990, 25 defense electronics companies competed for DoD contracts. If the Lockheed Martin-Northrop Grumman merger were to occur, it would leave only two companies —Lockheed-Martin and Raytheon —dominating defense electronics. This is of particular interest to the NMD Program because of the inordinate number of electronic components in the system. The procurement budgets in 1997 were 66 percent for missile components and 54 percent for space systems components.

Continued consolidation —specifically in the rocket motor, thermal battery, electronic, sensor, and communication equipment industry —are of concern to the NMD program and may impact the ability to produce and deploy the system. Several components were identified that have been affected by consolidation; as a result, these affected components are limited to a single or sole-source producer: cryogenic devices, beryllium metal oxides, Novoltex composite material, application-specific integrated circuits (ASIC), high-power amplifiers, transmit and receive (T/R) modules, radiation-hardened electronic parts (e.g., clocks, memory parts, power supply circuits, focal plane array).

Diminishing Manufacturing Sources (DMS)

Diminishing Manufacturing Sources (DMS) is a situation caused by the shrinking U.S. industry and the rapid advances in technology. This problem is particularly prevalent in aerospace and electronics industries.[2]

The aerospace industry is expected to face continued consolidation between now and 2005. Prime contractors will seek to enhance their competitiveness for a dwindling defense budget by applying downward streamlining pressures on the supplier chain. This increased competitiveness, coupled with the excess capacity within many defense industry segments —including aircraft, missile systems, and electronics —is expected to result in downsizing of the number of suppliers.

The NMD system, with its requirements for a range of sophisticated interceptors, sensors, and communication equipment, could be susceptible to the endemic DMS situation. The impact however, may be significantly reduced by the Open Systems Architecture approach in the system design we have adopted. This approach will also reduce life-cycle cost by facilitating upgrades using incremental technology insertion, rather than by system redesign.

Foreign Dependency

Recent experience with other advanced strategic and tactical missiles indicates that foreign sourcing is pervasive in the electronics arena. In fact, Department of Defense encourages the use of foreign sources to obtain a wider competitive cost and technology base, as long as foreign sourcing does not place the United States in the strategically vulnerable position of being unable to obtain electronic components, when needed. Reliable "foreign sources and international cooperative developments shall be used where advatageous and within the limitations of the law."[3]

Ultimately, the risk of foreign sources has to be weighed against the cost of buying components and systems domestically. The issue is vulnerability, not foreign dependency: As long as there are multiple sources in multiple countries, there is neither military nor economic vulnerability.

Previous studies have shown that although U.S. offshore dependency for missile systems is somewhat low at the immediate first-tier level, it increases dramatically as one investigates the lower second-tier subcontractor level.[4] Major imported components and processes for advanced missiles use technologies similar to those used for NMD system elements, including ceramic packages, silicon base wafers, socket contacts, transistors, and ball screws. Similarly, important imported *manufacturing equipment* consists of milling and turning equipment, machine centers, bonders, dicing saws, and CNC lathes.

Uncertainty notwithstanding, we remain committed to "3+3." In spite of the recent trends, our assessment showed the industrial base is capable of producing the NMD elements with the current production capacity for the development phase. Future requirements are also viewed as viable, assuming the industrial capabilities remain stable over the next few years.

The NMD JPO is committed to the "3+3" program in spite of the obvious high risk of the streamlined acquisition program. The year 2000 is the first opportunity to decide to deploy the NMD System or continue development based on the demonstrated capability of the system and the threat at the time. With this in mind, we are using an aggressive proactive management approach to reduce the program risk and prepare for the production and deployment of the system if the decision is made to deploy.

ENDNOTES

1. DoD Directive 5000.60-H, *Assessing Defense Industrial Capabilities* (DoD, April 25, 1996).

2. Electronic Industries Association, *Ten-Year Forecast Conference of Defense, NASA and Related Electronic Opportunities (FY 1998-2002)*, October, 1997, pp. 131-132.

3. Defense Federal Acquisition Regulation Supplement, Part 225, *Foreign Acquisition*.

4. TASC, *AMRAAM Industrial Base Analysis*, February, 1992; IDA, *Dependence of U.S. Defense Systems on Foreign Technologies*, February 1990.

The National Missile Defense Program

Advanced Capabilities to Counter Future Threats

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Upgraded Early Warning Radar (UEWR)

Defense Support Program/ Space Based Infared Geosynchronous and High Elliptical Earth Orbit Satellite (DSP/SBIRS GEO)

Ground Based I nterceptor in Flight INF1 Target Launch June 24, 1997

Space Based Infared System Low Earth Orbit (LEO) (Space and Missile Tracking System)

Kill Vehicle on Launch Site with Payload Shroud on the Ground Based Interceptor (GBI)

Battle/Management/Command, Control and Communications (BM/C^3) Center

Photos courtesy Ballistic Missile Defense Organization